



CITY OF CONCORD
CONCORD, NORTH CAROLINA

FOR

BID# 2244

MEDIUM-VOLTAGE MOTOR CONTROL EQUIPMENT (PHASE B)

FOR

CODDLE CREEK WATER PLANT

WATER RESOURCES DEPARTMENT

ANNOUNCED DATE: TUESDAY, AUGUST 26, 2014

DUE DATE: MONDAY, SEPTEMBER 8, 2014

TIME: 2:00 PM
IN CONFERENCE ROOM C
ALFRED M. BROWN OPERATIONS CENTER
850 WARREN C. COLEMAN BOULEVARD
P.O. BOX 308
CONCORD, NC 28025

REQUEST FOR BID

The City of Concord will receive sealed bids, on Monday, September 8, 2014 at 2:00 PM, in Conference Room C, Alfred M. Brown Operations Center, 850 Warren C. Coleman Boulevard, Concord, North Carolina 28025. Said proposals will be publicly opened and read for:

BID# 2244

MEDIUM-VOLTAGE MOTOR CONTROL EQUIPMENT (PHASE B)

Copies of the specifications if not included in the bid can be obtained by contacting the Purchasing Department, Alfred M. Brown Operations Center, 850 Warren C. Coleman Blvd., P.O. Box 308, Concord, N.C. 28025. Telephone # 704-920-5441, Fax # 704-785-8856.

NC General Statutes, including G.S. §143-129, and the city of Concord, NC General Specifications and Instructions to bidders will govern the RFB and award of the contract.

The City of Concord reserves the right to reject any or all bids.

Sid Talbert
Purchasing Manager
City of Concord, N.C.

In accordance with state law (G.S. 143.129), the award shall be made to the lowest responsible, responsive bidder, taking into consideration quality, performance, the time specified in the bid. Prices should be quoted for each line as well as a price for the total award.

Each bid must be submitted in a sealed envelope, so marked as to indicate its contents when being opened. **All bids should be marked BID #2244 MEDIUM-VOLTAGE MOTOR CONTROL EQUIPMENT (PHASE B)**

An authorized official of the firm must sign the bid.

The vendor will be required to submit a written request for payment. Payment will depend on projected delivery date stated in the bid for items and certified acceptable by Christie Putnam – Water Resources Director, for City of Concord, P.O. Box 308, Concord, North Carolina 28025. Telephone# 704-920-5343. Questions concerning bid requirements or specifications should be directed to the Purchasing Manager, Alfred M. Brown Operations Center, 850 Warren C. Coleman Boulevard, P.O. Box 308, Concord, NC 28025. Any changes in specifications will be in writing in form of an addendum and furnished to all bidders. Verbal information obtained otherwise will not be considered in the awarding of bids. No changes to specifications will be permitted within (5) days to the bid opening.

Instructions for preparation and submission of a bid/proposal are contained in the attached packet. Please note that specific forms for submission may be required. Any changes to the conditions and specifications must be in the form of a written addendum to be valid; therefore, the Purchasing Department will issue a written addendum to document on all approved changes. Any bid submitted which does not acknowledge the receipt of an issued addendum will not be considered. Bidders should have no contact with elected officials or appointed officials except the Purchasing Manager during the bidding process. Any such contact will subject bidders to immediate disqualification. Questions regarding specifications should be directed to the Purchasing Manager. A bid proposal from your firm will be appreciated.

Bid Proposal

City of Concord
P.O. Box 308
Concord, North Carolina

Gentlemen/Ladies:

The undersigned, as bidder, hereby declares the proposal is made without connection with any other person, company, or parties making a similar bid or proposal, and that it is in all respects fair and in good faith without collusion or fraud. The Bidder has carefully examined the annexed form of the specifications and instructions to the bidder and hereby declares that he will furnish the material called for in a manner prescribed in the specifications and instructions to bidders for the following prices listed.

PRICE _____

DELIVERY DATE _____

COMPANY NAME _____

AUTHORIZED SIGNATURE _____

TYPE NAME AND TITLE _____

FEDERAL ID # _____

NC CONTRACTORS LICENSE # _____

TELEPHONE # _____

Note:

This signature page must be signed for your bid to be valid.

GENERAL SPECIFICATIONS & INSTRUCTIONS TO BIDDERS

Scope

It is the intent of this bid invitation to obtain proposals for supplying the materials, supplies and/or equipment listed on the Proposal Sheet. You are requested to submit your bid on the enclosed Proposal Sheet and return the entire sealed package to Sid Talbert, Purchasing Manager, City of Concord (hereinafter "City"), PO Box 308, Concord, NC 28026-0308 no later than the time specified in the bid advertisement. Bidders will be required to comply with all applicable statutes, regulations, and local ordinances, ect. And those attached to and made a part of the proposal.

Marking of Bid Envelopes

Bids must be contained in a sealed envelope, plainly marked, showing the bid name, bid number, date, time for opening bids and the bidder's name.

Late Bids Not Considered

Bids received after the stipulated bid opening date and time will not be considered.

Compliance With Specifications

Your bid must be in strict compliance with the specifications and offer the same or equal equipment. Exceptions are to be listed separately in a letter that will become a part of your proposal; otherwise, it is fully understood that the equipment offered is exactly as specified. The City reserves the right to allow or disallow minor deviations from the specifications in order to purchase what is best for the City from a standpoint of quality, price and service to be rendered.

Standard Equipment

To protect the interest of the City, the bidder guarantees that the equipment bid is standard equipment with parts regularly used for equipment offered. There must be no parts or attachments substituted or applied contrary to the manufacturer's recommendations and standards unless expressly called for in the specifications.

Warranty

In submitting a bid, the bidder warrants that all goods furnished shall be free from all defects and shall conform in all respects to the Technical Specifications established herein. Unless otherwise specified, all items shall be guaranteed for a minimum of one (1) year against defects in material and workmanship. At any time during that period, if a defect should occur in any item, that item shall be repaired or replaced by the seller at no cost to the buyer except where it can be shown that the defect was caused by misuse. The bidder expressly warrants that all items bid are fit and sufficient for their intended purpose. If the specifications contain a statement of the particular

City of Concord North Carolina General Specifications and Instructions to Bidders.

purpose for which the goods will be used, the goods offered by bidder shall be fit for this purpose.

Shipping

All prices are to be quoted f.o.b. Concord N.C. delivered unless otherwise specified. Risk of loss and/or damage shall be upon the seller until such time as the goods have been physically delivered and accepted by the buyer.

Unit Prices to Prevail

Prices shall be submitted on per unit basis by line item. In the event of a disparity between the unit price and the extended price, the unit price shall prevail.

Bid Price Corrections

All prices and notations shall be written in ink or typed. Changes or corrections made on the bid form must be initialed by the individual signing the bid. No corrections will be permitted once bids have been opened.

Withdrawal of Bids

Bids may be withdrawn at any time prior to the time specified for the bid opening upon written or personal request of the bidder. No bid may be withdrawn for a period of sixty (60) days after the scheduled bid opening time and date. Negligence on the part of the bidder shall not constitute a right to withdraw the bid subsequent to such bid opening.

Use of Brand Names and References

Unless otherwise stated, the use of manufacturer's names and product numbers are for descriptive purposes and establishing general quality levels only. They are not intended to be restrictive. Bidders are required to state exactly what they intend to furnish; otherwise it is fully understood that they shall furnish all items as stated.

Alternate Bids

Bid submitted as alternate which do not meet or exceed the minimum specifications shall be rejected except that minor deviations may be acceptable. The City shall be the sole judge of what is considered a minor deviation.

Time For Delivery

The time for delivery must be stated in calendar days on the Proposal Sheet and may be a factor in making awards, price notwithstanding.

City of Concord North Carolina General Specifications and Instructions to Bidders.

Rejection of Bids

The City reserves the right to reject any and all bids.

Bonds

A 5% bid bond is waived for the purchases of apparatus, supplies, materials or equipment as stated in the cover section. A 100% performance bond is also waived.

Award

Award shall be made to the lowest responsible, responsive bidder, taking into consideration quality, performance, time specified in the bids for the performance of the contract.

Brochures and Literature

The proposal must be accompanied by descriptive literature marked, indicating the exact item(s) bid upon. The term "as specified" will not be acceptable.

Addendums

The City shall not be responsible for any oral instructions made by its employees or officers of the City with regard to bidding instructions, drawings, specifications or contract documents. Any changes to the specifications will be in the form of an Addendum, which will be mailed to all bidders who are listed with the Purchasing Department as having received the invitation or any other bidder who requests an Addendum.

Responsibility of Compliance With Legal Requirements

The bidder's products, service and facilities shall be in full compliance with any and all applicable state, federal, local, environmental and safety laws, regulations, ordinances and standards, or any standard adopted by nationally recognized testing facilities regardless of whether or not they are referred to in the invitation.

Taxes

The City of Concord is subject to 7% N.C. Sales & Use tax. Tax will not be shown on the proposal; however, invoices will indicate all applicable sales tax. The city is exempt from Federal Excise Tax and will provide a Federal Exemption number.

Terms and Conditions

Payment will be made by the City in full for all equipment delivered as soon after complete delivery and receipt of a correct invoice as can be processed in accordance with these specifications.

City of Concord North Carolina General Specifications and Instructions to Bidders.

Any company submitting a “No Bid” response to a bid invitation should clearly mark the outside of the envelope.

Terms and Conditions attached to the bid by the bidder and made a condition of purchase may render the bid non-responsive and may be rejected by the City.

Terms and Conditions included herein are an integral part of the bid document and shall prevail, unless changes or attachments are agreed to and initialed by the City prior to the bid opening.

Introduction in Use of Goods: Demonstration

A demonstration may be required of the goods bid upon. The demonstration shall be at no cost to the City. If the bidder cannot make a demonstration within twenty days of the request, his or her bid may be rejected. Performance of the equipment at the demonstration must be made with the exact equipment offered in the bid and may be completed at the same time as competitive demonstrations.

Trade-ins

Goods listed for trade-in, if any, may be examined after contacting the Purchasing Department. Goods listed for trade-in are represented “as is” and “where is”. Such goods will be released to the successful bidder after receipt of the new equipment and in the same condition as when examined, excepting normal wear and tear.

The City reserves the right to retain goods listed as trade-in if it is deemed to be in the best interest to do so.

Training/Safety

When requested or required, a factory-trained representative shall be present at the time of delivery to train City personnel in the use of and/or safety aspect of the equipment or chemical. The factory representative shall effectively train the City personnel in all aspects, including assembly, disassembly, operating procedures, safety and any other training necessary for its safe and effective use. Items received without sufficient training when requested will be set aside and payment withheld until sufficient training can be completed.

Training shall include OSHA related training in the handling of hazardous materials.

MSDS sheets must be sent with each order. Failure to provide MSDS sheets prior to or at the time of delivery will result in withholding payment until such sheets are received.

Service

City of Concord North Carolina General Specifications and Instructions to Bidders.

All vehicles furnished under a bid shall receive without additional cost whatsoever the usual check-up, guarantees and adjustment identical to that which is normally furnished on vehicles sold to the general public.

Manuals

One parts, one service, and one operators manual shall be furnished with each type vehicle delivered if applicable to this bid.

Bankruptcy

Successful bidders shall execute a contract that contains the following language:

If any bankruptcy or insolvency proceedings are commenced against the contractor
And are not dismissed within thirty (30) days after service of such proceeding on the
Contractor, or if the contractor shall file petition in bankruptcy or for reorganization or
To effect a plan or other arrangement with creditors, or be adjudicated bankrupt or make an assignment for
the benefit of creditors, or be dissolved or liquidated, or shall
Admit in writing its inability to pay its debts generally as they become due, or a receiver, trustee or
liquidator of the contractor or of all or substantially all of the property of the contractor is appointed in any
proceeding brought by the contractor, or if any such receiver, trustee, or liquidator is appointed in any
proceeding against the contractor, and any such receiver, trustee or liquidator is not discharged within (30)
days after service of such appointment on the contractor, this agreement shall be null and void.

W-9 Form

Prior to the first payment by the City under any contract awarded to the successful bidder, the
successful bidder shall submit a complete and accurate W-9 form to the Purchasing Manager.

Dissolution of Corporate Status

Successful bidders shall execute a contract that contains the following language:

Failure to register the agent of the corporation or other business entity, if any, with the N.C.
Secretary of State or voluntary, judicial or administrative dissolution of the corporation or other
business entity shall automatically terminate this contract or agreement unless the bidder or
contractor notifies the City of Concord in writing within 72 hours of the dissolution or failure to
register the agent and makes satisfactory arrangements and/or guarantees with the City
Purchasing Officer and City Attorney to fulfill the contractors obligations under the contract or
agreement.

Concord NC Licenses and Taxes

City of Concord North Carolina General Specifications and Instructions to Bidders.

ALL BIDDERS SHOULD BE IN COMPLIANCE WITH THE CITY OF CONCORD PRIVILEGE LICENSE TAX ORDINANCE AND AWARD OF BID WILL BE CONTINGENT UPON RECEIPT OF COPY OF LICENSE.

It is the intent of the City of Concord to issue purchase orders for the bid items to cover the Fiscal Year July 1, 2014 to June 30, 2015. Quantities are estimates only and the City reserves the right to purchase more or less for the entire fiscal year and extend pricing if mutually agreed upon with the vendor and the City of Concord.

MEDIUM-VOLTAGE MOTOR CONTROL EQUIPMENT (Phase B)

PART 1 - GENERAL

1.01 Scope of Work

Phase A (note: Phase A is complete)

- Replacement of Main Fused Load Break Switch
- Replacement of Motor Controllers with RVSS Controllers for Pump 1, 3, and 5

Phase B shall include the replacement of the Tie, Main, and Motor Controllers for pump 2 and 4.

1.02 General

Equipment furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the specifications and recommendations of the equipment manufacturer, unless exceptions are noted by the specifications.

All equipment to be furnished shall be designed, constructed, and tested in accordance with UL 347 and NEMA ICS 3-1993.

1.03 System Characteristics

The equipment will be connected to a 4,160 Volt, 60 Hz, 3 Phase, three wire, solidly grounded system.

The motor controller lineup shall have an interrupting rating of 350 MVA symmetrical at 4,000 Volts. The power bus shall be braced for 50 kA symmetrical or greater.

1.04 Submittals

Complete assembly, foundation, and installation drawings, together with complete engineering data covering the materials used, parts, devices, and accessories forming a part of the motor controllers. Submittals shall include:

Motor Controller Lineup

Elevation, plan, and weight

Unit wiring diagrams showing devices, connections, and terminal designations

Interconnection diagrams

Control schematic diagrams

Fuse time-current characteristic curves

Motor protective relay time-current characteristic curves

1.05 Special Tools and Spare Parts

All special tools and other devices normally furnished or required for installation, care, and maintenance of the controller equipment shall be furnished. The spare parts shall be stored as directed by the Owner. As a minimum the following spare parts shall be delivered with the medium voltage motor control lineup. If any of the spare parts are used during the installation process, they shall be replaced by the manufacturer at no cost to the Owner.

Provide spare parts - three (3) fuses of each size used (packed for long term storage).

1.06 Warranty

Warranty period (full parts and labor) shall be 12 months from the date of substantial completion.

Part 2 – PRODUCTS

2.01 Acceptable Manufactures

Each motor control lineup assembly shall be the product of a manufacturer of industrial motor starters and power switch equipment who has supplied such equipment, both individually and in integrated industrial control equipment assemblies, for at least 5 years.

The equipment shall be manufactured by Rockwell Automation/Allen-Bradley. Other manufactures shall be considered but they must submit detailed data sheets for review by the owner not less than 8 days before the bid.

2.02 Construction

The control lineup shall confirm to the arrangement, on-line diagram, schematics, and requirements indicated on the drawings or specified herein. The control lineup shall be set up for bottom feed. Each incoming main load break switch shall be set up for bottom feed. Each RVSS shall be set up for bottom exit, and shall re-use the existing conduits.

The lineup shall be braced for seismic forces in accordance with the North Carolina Building Code.

If necessary, pad extensions shall be handled by the installer.

2.03 Sills and Anchors

The Contractor shall furnish and install steel channels, floor sills, and anchor bolts as required by the equipment manufacturer for proper installation.

2.04 Enclosures

Enclosure shall be NEMA Type 1 for indoor locations.

2.05 Wiring Labels

All internal wires shall be labeled at each termination. Terminals shall also have labels giving the terminal block and terminal number.

2.06 Nameplates

Nameplates with unit description and designation of each control or indicating device shall be provided on hinged doors. Nameplates shall be black and white laminated phenolic material of suitable size, and shall be engraved with 1/2-inch high letters for section identity and 3/16-inch letters for other information. The engraving shall extend through the black exterior lamination to the white center.

Each control device and each control wire terminal block connection inside the units shall be identified with permanent nameplates or painted legends to match the identification on the manufacturer's wiring diagram.

The motor control lineup shall be provided with a nameplate identifying the manufacturer's name, address, and catalog number securely affixed to the equipment. The nameplate of the distributing agent only will not be acceptable.

2.07 Vertical Sections

The equipment furnished shall be of one-high type construction in which a single reduced voltage solid state motor controller requires a full-height section of the equipment.

One-high construction shall utilize the full height of the section. Standard two- high construction, with the top half of each section unused space, will not be considered as meeting this specification.

Equipment shall consist of a lineup of freestanding, metal-enclosed cubicles forming an integrally built group of medium-voltage control. All connections and servicing shall require access from the front only.

The individual sections shall be divided into high voltage and low voltage compartments, to ensure isolation of equipment for safety of personnel during servicing and maintenance or cable pulling, while adjacent sections of the group remain energized.

2.08 Busing

All buses shall be tin-plated copper. The main horizontal bus shall be located in an isolated bus compartment within or at the top of the enclosure and shall be rated at 1200 amperes as indicated on the drawings.

A copper ground bus shall be furnished through the lineup. A clamp type connector shall be provided on each end of the ground bus for external connection of up to a 500 kcmil stranded copper grounding cable to the grounding system. A clamp type connector shall also be provided in each controller section for connection of stranded copper grounding cable run with incoming and outgoing phase wires, as indicated on the drawings.

2.09 Motor Controller Units

Each controller unit shall consist of an externally operable isolation switch and magnetically operated vacuum contactors with current limiting fuses.

All controllers' components shall be rated to start a 600 horsepower motor.

2.10 Main Disconnects

Each main disconnect shall include a gang-operated 600 amp rated load break fused switch. Load break switch and fuse units, instrument transformers, buses, and outgoing cable connections shall be provided in separate compartments formed by grounded steel barriers. Key interlocks shall be provided where indicated on the drawings to prohibit both main switches and the tie switch from being closed at the same time.

Installer to handle proper connection of the new Main Fused Load Break Switch to the existing Tie via cabling (new cabling to be supplied by installer).

2.11 Load Break Switches

Gang-operated load break fused switches shall comply with the performance requirements of UL 347.40. Switches shall be stationary, manually operated, three-pole, single-throw disconnecting type, with integral interrupter and stored-energy mechanism. Each switch shall have an external operating handle, with provisions for padlocking the switch in the "Off" position. Mechanical interlocks shall be provided to prevent the switch from being operated when the door is open and the door from being opened when the switch is closed.

Fuses shall be sized and furnished by the equipment manufacturer.

A viewing window shall be provided at each switch to display the condition and position of the switch blades.

2.12 Isolation Switches

Each controller shall be isolated by a quick-make quick-break isolation switch with an externally mounted operating handle. Mechanical interlocks shall be provided to prevent operation of the isolation switch under load, opening of the high-voltage compartment door before the controller is isolated, and closing the contactor while the door is open.

2.13 Solid-State Controllers

Controllers shall be reduced voltage solid-state motor starters designed and manufactured to conform to Part ICS 2.324 of the NEMA standards as a Class E1 controller. The horizontal bus work and the cabling bus from the main power cell shall be braced and tested in accordance with NEMA/EEMAC ICS 2.324 through ICS 2.325 and UL 347.

Each solid state controller shall be provided with a factory wired and tested Ethernet communication system capable of communicating Ethernet/IP. Ethernet capable devices shall be installed in each solid state controller and connected to the pumping station via a dedicated Cat-6 cable.

Control power for each Ethernet capable device shall be provided by individual unit control power transformer or power supply.

2.14 In-Line Contactor

The magnetic power contactor shall be vacuum break type, fixed-mounted style. The contactor shall electrically interlock with the main isolating switch providing the following safety features:

- a. Prevents the isolating switch from being opened or closed when the contactor is closed.
- b. Prevents opening the medium voltage door when the isolating switch is closed.
- c. Prevents closing the isolating switch when the medium voltage door of the controller is open.
- d. Removes the power to the control circuit when the isolating switch is open.

2.15 Bypass Contact

The bypass magnetic contactor shall be vacuum break type, fixed mounted style. It shall be used to bypass the SCR power poles once the motor is up to full speed. When stop is commanded, the bypass contactor shall open to allow the SCR poles to operate once again just before shutdown.

2.16 Controller Operating Features

The controller shall be provided with the following features:

- a. Adjustable ramp time (0 - 120 seconds)
- b. Adjustable initial current (50 - 400%)
- c. Adjustable maximum current (200 – 600%)
- d. Short SCR detection
- e. Software selectable relay output
- f. Event recorder
- g. Line frequency status
- h. LCD status display
- i. Full voltage start

2.17 Motor and Controller Protection

The manufacturer of the reduced voltage solid-state motor starters furnished under this section shall be responsible for the coordination of the fused isolation switch, in-line contactor, SCRs, bypass contactor, current transformers, overload relays, surge limiters, current limiting fuses, power factor correction capacitor contactor, and the capacitors. In selecting suitable components, the following requirements shall apply:

- a. Protection of the motor against sustained overloads and against locked rotor conditions by means of the overload relay.
- b. Protection of the fuses against sustained currents above their continuous ampere rating but below their melting value by means of an overload relay.
- c. Protection of the circuit by means of the contactor within the interrupting limits of the contactor and below the operating time of the fuses.

d. Protection of the circuit, contactor, current transformers, and overload relays from the damaging effects of maximum fault currents by means of properly sized current limiting fuses.

e. Protection of the motor against voltage surge by means of surge limiters.

2.18 Current Transformers

Current transformers as needed for Motor Protection Relay and the Metering Package.

2.19 Potential Transformers

Potential transformers as needed for Motor Protection Relay and the Metering Package.

2.20 Control Power Transformers

Individual control power transformers shall be provided with each contactor and each motor starter. The transformer primary windings shall be fused and the secondary windings shall have one lead fused and the other grounded. Control power transformers which serve external device loads shall have extra capacity for motor space heaters and other associated equipment.

2.21 Control Test Circuit

Test control power interlocking provisions shall allow testing of contactor or starter control operations from an external source of 120-volt control power with the high voltage disconnected and isolated.

2.22 Cable Connectors

Crimp-type terminal connectors for incoming and outgoing power cables shall be provided in each section. Connectors shall match the size of cables and the number of cables per phase as indicated on the drawings. Connectors to the ground bus shall be provided in each section for connecting the grounding cable in each power circuit.

2.23 Control Switches

Control, selector, and instrument transfer switches shall be of the multiple stages, rotary type. Number of contacts, position names, and action shall be as indicated on the drawings.

All pilot lights, pushbuttons, and selector switches shall be Allen Bradley 800T, 30.5 mm, non-metallic. Pilot lights shall be push to test, transformer type with LED bulbs.

2.24 Auxiliary Contacts

Auxiliary contacts for interlocking and control shall be furnished as indicated on the drawings. In addition, one spare N.O. isolated contact and one spare N.C. isolated contact shall be provided on each controller.

2.25 Metering Package

Each RVSS motor controller shall be equipped with a power monitor to meter voltage, current, frequency and power. It should calculate energy consumption, power factor and total harmonic distortion.

The power monitor shall have Ethernet communication capability.

The power monitor furnished shall be manufactured by Allen-Bradley and shall be Powermonitor 5000.

2.26 Solid-State Motor Protection Relay

Each motor shall be protected by a motor protection relay (MPR) as indicated on the drawings. The relay shall provide protection, metering, and monitoring functions. The relay shall be manufactured by General Electric and shall be GE Multilin Model 469 Motor Management Relay without exception.

The relay shall have Ethernet communication capability.

2.27 Control and Data Network Equipment

Furnish the labor and materials required to install the control and data onto the Control System Network.

- a. Provide and install from each RVSS controller a CAT. 6 cable to Pump Station PLC-6.
- b. Provide and install an Ethernet Switch, an Ethernet Media Converter, a fiber optic patch panel, and all necessary components to control panel PLC-6.
- c. Provide and install fiber optic cable from Pump Station PLC-6 to Main Building PLC-1.
- d. Provide and install an Ethernet Media Converter, a fiber optic patch panel, and all necessary components to Main Building PLC-1.

2.28 Wiring

All external connections to the equipment will enter at the bottom. Provide as much space as possible for conduits in unit floors and tops. All spare contacts shall be wired to terminals for external connections. In addition to spare contact terminals and spare terminals, terminals marked to match the manufacturer's drawing shall be provided for all connections wired through the controllers.

2.29 Shop Painting

All iron and steel surfaces, except machined surfaces and stainless steel, shall be shop painted with the manufacturer's standard coating. Finish color shall be ANSI 49. Field painting, other than touchup painting, will not be required. One quart of additional coating material and thinner shall be furnished to permit field touchup painting of damaged coatings.

2.30 Shop Tests

The complete control lineup shall be tested at the factory. All circuit, including power and control circuits, shall be tested in accordance with NEMA 2-324 and 325.

PART 3 - EXECUTION

3.01 Installation

Equipment shall be installed in accordance with the Electrical Equipment Installation section and in accordance with the equipment manufacturer's recommendations.

3.02 Installation Check

An experienced and authorized factory direct personnel of the manufacturer shall visit the site of the Work and shall perform field services as specified in paragraph 3.03.

The authorized factory direct personnel shall furnish a written report certifying that the equipment has been properly installed.

3.03 Manufacturer's Field Services

Provide one (1) site visit of one day for equipment start-up and testing. These services shall be provided and included by the awarded solid-state starter manufacturer and be from factory-direct personnel. The use of agents, manufacturer's representative, associated integrators, or manufacturer's distributors for these requirements shall not be permitted.

3.04 Training of Owner's Personnel

After the system has been successfully field tested and checked out, provide one four-hour session for maintenance and operator training for up to 10 Owner's staff at the Owner's facility.

END OF SECTION